

For the McCaslin route, strong signal strengths are observed in the middle part of the route, and as the route turns back towards the Flatirons, deep shadowing regions are observed. For the Boulder-to-Golden route, strong signal strengths are observed on Indiana Avenue. However, once the route turns back to Highway 93, deep shadowing is observed in both results. This difference is due to the fact that the ITM does not take into account the full three-dimensional terrain features, and as a result, it underestimates the field strengths.

Once again, this situation only occurs in deep shadow regions. Figures 53, 54, and 62 show that for moderate shadow regions (the Table Mountain NRQZ and the Broadway route), the ITM predictions compare very well to the measured values, illustrating the accuracy of the ITM for moderate shadow regions. In any event, ITM predictions are conservative, since in deep shadow locations the predicted field strengths are less than those that were measured.

5. PREDICTED E-FIELD STRENGTHS FOR THE PROPOSED TOWER HEIGHTS

The previous section demonstrated that the ITM model can accurately (except in deep shadow regions, as explained above) predict field strengths for both LOS and non-LOS locations for a given antenna height. Therefore, this model was used with confidence to calculate and predict field strengths for the actual proposed antenna heights for both the Eldorado Mountain and Squaw Mountain sites.

Figures 65 and 66 show contour plots of the E-field strengths for the Boulder–Denver area for a transmitter located at Eldorado Mountain for 533 MHz and 772 MHz, respectively. The results in these figures are for horizontal polarization with a transmitter antenna height of 116 m (379 ft), and a receiver height of 2 m (6.6 ft). Figure 67 shows the E-field strengths at the Table Mountain NRQZ for 533 MHz and 772 MHz. From this figure it is seen that for the Table Mountain NRQZ, the predicted field strengths are about 0.2 V/m. This value, based upon transmission from Eldorado Mountain, exceeds the FCC regulatory limit by about an order of magnitude (or by about a factor of ten in E-field strength). This level of excess would thus jeopardize the research at the Table Mountain NRQZ.

Figure 68 shows the E-field strengths at the DOC Laboratories for 533 MHz and 772 MHz. From this figure it is seen that for the DOC Laboratories, the predicted field strengths approach 0.5 V/m to 1 V/m at various locations. These field strengths are high enough to affect some of the sensitive measurements performed on a routine basis at the DOC Laboratories, see Section 8.

The Squaw Mountain site is analyzed next. Figures 69 and 70 show contour plots of the E-field strengths for the Boulder–Denver area for a transmitter located at Squaw Mountain for 533 MHz and 772 MHz, respectively. The results in these figures are for horizontal polarizations with a transmitter antenna height of 60.96 m (200 ft), and a receiver height of 2 m (6.56 ft). Figure 71 shows the field strengths at the Table

Mountain NRQZ for 533 MHz and 772 MHz. The difference in field strengths for the two frequencies is due to the fact that the amplitude of the diffracted wave decreases with increasing frequency. From this figure it is seen that for the Table Mountain NRQZ, the predicted field strengths are about 0.1 mV/m to 0.2 mV/m. These field strengths are well within the FCC Table Mountain NRQZ regulatory limits. Thus, a transmitter can be located at Squaw Mountain without violating the FCC regulatory limits or jeopardizing the research efforts at the Table Mountain NRQZ.

Even though the DTV frequency allocation is in the 400 MHz to 700 MHz band, there is the possibility that broadcasters could decide to broadcast DTV signals at their currently assigned NTSC frequencies [29]. This means that some DTV transmissions could be below 400 MHz. Since propagation loss can decrease with frequency, it is important to calculate field strengths that would result from broadcasting at the lower NTSC frequencies. Field strengths were calculated at 54 MHz (the lowest NTSC frequency) at the Table Mountain NRQZ and at the DOC Laboratories with the transmitter on Eldorado Mountain and Squaw Mountain. These results are shown in figures 67, 68, and 71. In figure 67, it is seen that the 54 MHz results are very similar to the 533 MHz and 772 MHz results for a transmitter on Eldorado Mountain. The similarity in the results for all three frequencies is due to the fact that the Table Mountain NRQZ is LOS from Eldorado Mountain. For a transmitter on Eldorado Mountain, the E-field strengths for all three frequencies exceed the FCC limit. In figure 71 (transmitter on Squaw Mountain), it is seen that the 54 MHz field strengths are somewhat larger than those at the other two frequencies (due to diffraction effects). As seen in table 2, the FCC NRQZ limit is smaller for 54 MHz. The predicted E-field strengths for a transmitter on Squaw Mountain at 54 MHz do exceed this FCC limit.

Here again, the data presented in this section are for an EIRP of 1 MW. Since some DTV broadcasters have received allocations to transmit at 1.64 MW (see table 1), predicted field strengths for 1.64 MW are needed. The E-field presented here can be converted to a 1.64 MW EIRP level by multiplying the results in all the figures by a factor of 1.3, resulting in even higher E-field strengths than those presented here. This would result in even greater E-field strengths in the Boulder–Denver area, and would cause even greater interference at both of the DOC facilities due to a transmitter located on the Eldorado Mountain site.

6. DTV E-FIELD STRENGTH REQUIREMENT

Measured and modeled results to this point have assumed either a 2 m (6.6 ft) or 2.95 m (9.68 ft) receiving antenna height. Designs of tower locations and power requirements are based on the FCC's 9.14 m (30 ft) receiver antenna height assumption. For acceptable DTV reception, the FCC has recommended a minimum E-field strength of 41 dB μ V/m (0.11 mV/m) at a 9.14 m (30 ft) receiver antenna height [1]. The ITM prediction model can be used to determine at what locations in the Boulder–Denver area the 41 dB μ V/m field strengths for a 9.14 m (30 ft) receiving antenna height can be achieved for given tower locations.